Department of Statistics
2020/21 – Semester I

STA101 LEC07 – Tutorial Exercise 5 (Modified)

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1. Consider the following matrices

$$\mathbf{A} = \begin{bmatrix} 2 & -3 & 9 & -4 \\ -11 & 2 & 6 & 7 \\ 6 & 0 & 2 & 9 \\ 5 & 1 & -5 & 8 \end{bmatrix}; \mathbf{B} = \begin{bmatrix} 3 & -1 & 2 \\ 0 & 1 & 4 \\ 3 & 2 & 1 \\ -1 & 0 & 8 \end{bmatrix}; \mathbf{C} = \begin{bmatrix} 2 & 1 & 1 \\ -1 & 1 & 4 \end{bmatrix}; \mathbf{D} = \begin{bmatrix} 2 & 3 \\ -1 & 1 \\ 0 & 5 \\ -2 & 3 \end{bmatrix}$$

   (a) Write down the size of each matrix $\mathbf{A}$ to $\mathbf{D}$.

   (b) Write down the elements a_{14}, a_{31}, b_{32}, c_{22} and d_{42}.

   (c) Identify all the pairs of matrices that are conformable for multiplication.

   (d) Find the transposes of all the matrices above.

2. Solve the following matrix equation for x, y and z

$$\begin{bmatrix} x & 3 \\ z & 2 \end{bmatrix} + \begin{bmatrix} 2-y & z \\ 2-z & -x \end{bmatrix} = \begin{bmatrix} 3 & 7 \\ 2 & 0 \end{bmatrix}$$

3. Given $\mathbf{A} = \begin{bmatrix} 1 & -2 \\ 3 & 4 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} -1 & 1 \\ 2 & 3 \end{bmatrix}$;

   (a) Find $\mathbf{D}$ such that $2\mathbf{A} - 3\mathbf{D} = -\mathbf{B}$

   (b) Compute $\mathbf{AB}$

4. Find $\mathbf{D}$ if $\mathbf{A} - 2(\mathbf{B} + \mathbf{D}) = 2\mathbf{C}$ given that $\mathbf{A} = \begin{bmatrix} 2 & 6 \\ -2 & 2 \end{bmatrix}$, $\mathbf{B} = \begin{bmatrix} 3 & -1 \\ 1 & 2 \end{bmatrix}$ and $\mathbf{C} = \begin{bmatrix} 2 & 1 \\ -3 & 3 \end{bmatrix}$.

5. Show that $\left(\mathbf{A}^T\mathbf{B}^T\right)^T = \mathbf{BA}$ for the following pairs of matrices

   (a) $\mathbf{A} = \begin{bmatrix} -1 & 0 \\ 1 & 2 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} -1 & 2 \\ 0 & -2 \end{bmatrix}$

   (b) $\mathbf{A} = \begin{bmatrix} 1 & 4 & -1 \\ 1 & 0 & 2 \\ -2 & 1 & -1 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} 2 & 1 & -1 \\ -1 & 3 & -2 \end{bmatrix}$